

# INTERPHASE<sup>TM</sup> Pilot GPS

## Global Positioning System Receiver



**INTERPHASE**  
TECHNOLOGIES, I.N.C.

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## Operation Manual

### To Our Customer:

Thank you for choosing the Interphase Pilot GPS receiver. Throughout the development of this fine product, we have been primarily concerned with creating a unit that offers the best possible value for your money. Selection of features, ease of use, superior performance and outstanding reliability were the benchmarks upon which all important design decisions were made. We are proud of the Pilot GPS and your satisfaction is very important to us.

To this end, we welcome any comments or suggestions that you might have in regard to this equipment.

It is very important that you complete the WARRANTY REGISTRATION CARD and return it as soon as possible.

Sincerely,

INTERPHASE TECHNOLOGIES, INC.

### IMPORTANT NOTICE:

Navigation based solely on one method or one instrument should never be practiced. The Pilot GPS should be considered as an aid to navigation, not as the only means of navigation. While the Global Positioning System is usually reliable and accurate, certain conditions and some locations may cause deterioration in performance of this or any other GPS. It is therefore important for the new user to learn about the limitations of this system.

## Interphase Pilot GPS Video Operation Guide

Interphase has a video instructional aid for the Pilot GPS available. It includes a basic description of the Global Positioning System and terminology; a helpful glossary; a step-by-step lesson on how to start your unit, save waypoints; and how to use the many special features of your Pilot GPS. Whether you are a beginner or an experienced GPS user, this video is a very helpful addition to your operation manual.

See your **Interphase Dealer** for this video or call Interphase at (408) 426-2007.

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# Warranty Information

Interphase Technologies, Inc. provides a limited one-year warranty on the Pilot GPS. Please note that there are limitations to our warranty. We strongly urge you to read this warranty reprinted at the back of this manual and closely follow its terms and conditions should your receiver require repair. Please note that all repair work performed during the warranty period must be performed by Interphase or an authorized Interphase Service Center for the unit to remain under warranty.

Should you experience a problem with your Pilot GPS, first refer to the Troubleshooting section of this manual. Most common problems and their solutions are described here. If problems persist, call Interphase Customer Service (408) 426-2007. We will be happy to try to assist you and if required will give you instructions on how to quickly get your set repaired.

Interphase maintains a staff of trained technicians in Santa Cruz, CA who can quickly repair and return your set to its original specifications. We strongly recommend that for the fastest service, if your set does require repair, you send it direct to Interphase and not return it to the dealer. For fastest response, please make a copy of or fill out and use the repair request form at the end of this manual. Mark the outside of the box "FOR SERVICE REPAIR".

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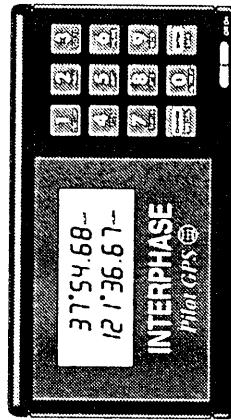
# General Information

The Interphase Pilot GPS, with its rugged, water resistant construction, is ideal for installation on nearly any type of boat. It includes the latest advancements in multi-channel continuous receiver technology, tracking up to eight GPS satellites, capable of providing accurate position information every second. It is also completely differential ready for the ultimate in DGPS precision navigation.

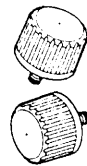
The Pilot GPS is one of the most user friendly marine electronics available today. Position, navigation, waypoint access and special functions are all available with the simple touch of a button. The large 12-button silicon rubber keypad makes operation a snap. Included are an adjustable waypoint arrival alarm and anchor alarm.

The Pilot GPS design is compact, yet the digital displays of Latitude, Longitude, TDs, cross-track error, magnetic bearing and distance in nautical miles to a destination, course over ground, time to go, boat speed in knots, time and date, and satellite status are clearly visible on the backlit LCD display. The Pilot GPS will store up to 100 waypoints and 10 routes. Navigational information can be calculated and displayed from the boat's current position, or from any waypoint to any other waypoint. One button "Take Me Home" and "Man Overboard" features are included for instant access and safety.

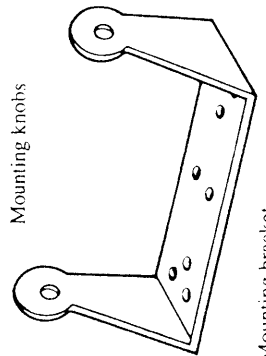
The Pilot GPS's very low power consumption (less than 0.5 Amps at 10-16 VDC) makes it ideally suited for many of today's smaller boats, or cruising boats, with limited power availability.



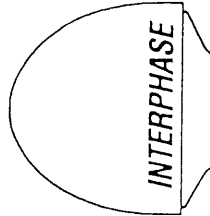
Interphase Pilot GPS display unit



Mounting knobs



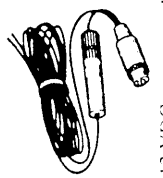
Mounting bracket



External antenna



Antenna cable



12 VDC power cord

# Installation

## Display Unit

The compact size of the Pilot GPS allows for easy installation in most any boat. To get maximum performance and life from your unit, the following guidelines should be considered when selecting a mounting location:

- 1) Select a location where the unit is protected from excessive temperature. Heat is one of the worst enemies of electronic components, and will accelerate component aging, thereby reducing the trouble-free life of your **Pilot GPS**.
- 2) Mount the display in a location where it will be convenient to route the power and antenna cables.

**NOTE:** An optional, in-dash mounting bracket is available for the **Pilot GPS** display unit. Contact your nearby **Interphase Dealer** or the **Interphase Accessories Sales Department** (408) 426-2007.

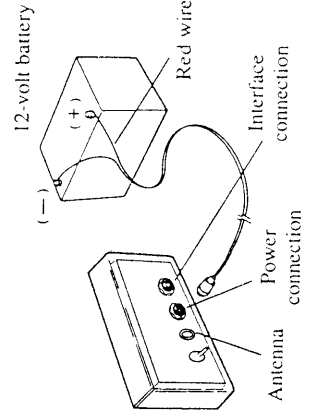
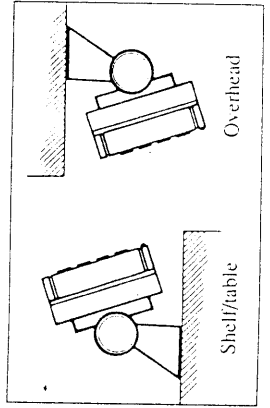
## Power Connection

The **Pilot GPS** requires a power source with a voltage level from 10 to 16 VDC. Low voltage may cause a dim display, reduced signal, weak beeper and a slow turn on. High voltage may eventually result in failure of some internal part. The nominal voltage found on most properly operating marine power systems is 13.6 VDC. It is recommended that you check the voltage supply which you intend to operate for the proper level.

Connect the two-pin plug on the end of the power supply cable to the power supply jack located at the rear of the unit. Connect the red wire to the positive terminal and the black wire to the negative terminal of your boat's 12 VDC battery, or the corresponding connections of the main distribution panel. Avoid connecting directly to the same circuit with any electronics which tend to draw a large amount of power, such as bilge pumps, refrigerators and transmitting radios.

The power cord included with the **Pilot GPS** includes an in-line fuse holder with a 1.6 Amp fuse installed. Be certain when connecting the power cord to the battery that the correct polarity is observed or the fuse may blow and possible circuit damage may occur.

**WARNING:** Never replace the **Pilot GPS** in-line fuse with a fuse rated higher than 2 Amp. Always replace with a fuse with a rating between 1 Amp. and 2 Amp. Before replacing the fuse check all connections. If the fuse continues to blow, return the entire system to **Interphase** for service.



## Antenna Installation

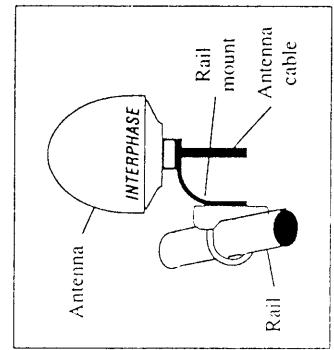
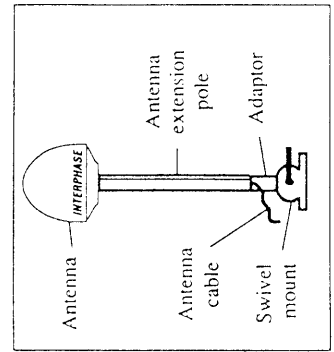
The Pilot GPS antenna is active, employing a 35 dB pre-amp and band pass filters. It is housed in a durable, completely waterproof casing designed for mounting in an open location. For optimum signal reception, mount the antenna with a 360 degree view of the sky so that it can have line-of-sight tracking of the satellites. Prevent objects such as poles, rails, other antennas and large cables from obstructing the view between the GPS antenna and the satellites. Avoid mounting at the top of a mast, since this location accentuates boat motion.

Care must also be taken in choosing a mounting location where radar beams or communications transmitter beams WILL NOT be directed towards the GPS antenna. For best results, mount the GPS antenna below and at least ten feet away from satellite communication equipment.

Mount the antenna on a level surface, such as a cabin top, or on the bow or stern rail. The Pilot GPS antenna is designed for a marine pole mount. The threaded socket at the base of the antenna accepts a 1"-14 straight thread which is a common antenna mount available at marine hardware suppliers. The antenna connector is located within the threaded socket, which allows the cable to be routed through the pole. We suggest using a 1', 2' or 4' Shakespear marine antenna extension pole. Use a Newmar Ioran coupler adaptor, Part No. 228-N, to permit the cable to run out the side when you mount the pole to a standard marine antenna mount. For rail mount installation we recommend the Rail Base, Part No. 3001, from Blue Sea Systems, (206) 738-8230.

The Pilot GPS antenna cable is RG-59, 75 Ohm coaxial and is 30 feet in length. This cable is especially made for low loss of signal to the receiver. Spare or replacement cables are available from your local Interphase Dealer or by contacting the Interphase Accessories Sales Department (408) 426-2007.

Although we do not recommend cutting the antenna cable, or removing the antenna cable connectors, if a replacement becomes necessary, you can obtain parts at most electronic supply stores. Available from Radio Shack stores are standard Type F coaxial connectors (Part No. 278-228A, 278-214 or 278-223). For replacement antenna cable, use a multiple shielded 75 Ohm coaxial such as RG-59, or Radio Shack RG6-QS, Part No. 278-1317. For best results, it is recommended to have the original Pilot GPS cable and connector at the antenna end and not have more than 50 feet total cable length (There is no minimum recommendation on cable length). When routing the cable from the antenna to the Pilot GPS, avoid sharp bends or kinks in the cable, hot surfaces, rough or sharp surfaces and corrosive fluids or gases.



# Basic Operation

## The Pilot GPS Keypad

The Pilot GPS has been designed to be as easy to learn and operate as possible. The 12 large push button keys are clearly labeled and have been kept to a minimum. The Pilot GPS responds with an audible beep each time a key is pressed. The special silicon rubber keypad is durable and waterproof, designed to last for years and years.

There are two modes of operation with the Pilot GPS keypad. While navigating, you will be in the Function Mode and all the functions below each keypad number will be active, as well as SPECIAL and SAVE. The Editing Mode is in use whenever the flashing cursor is on the screen, and each keypad number will be active, as well as CHANGE, ALT/NEXT and ENTER.

## Common Function Keys

The SPECIAL feature is available in order to use additional features of the Pilot GPS. The Special features are described later in this manual, and this section should be carefully read before use, since some of the Special functions, if incorrectly executed, could result in erroneous navigational data.

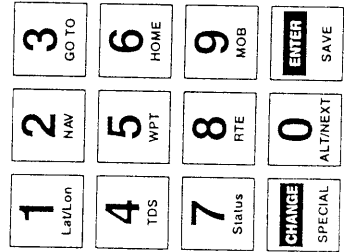
The SAVE key is used while navigating to instantly store your boat's present position. This is the easiest and most accurate means of storing a waypoint in the Pilot GPS.

## Common Edit Keys

The CHANGE key is used when you are in the editing mode. If you make a mistake when entering a number, the CHANGE key is used to "erase" a previous entry, or to "go back a step".

The ALT/NEXT key is used in the editing mode. For example, ALT would be used to alternate through various choices such as North Latitude & South Latitude, or East Longitude & West Longitude. You would use NEXT to increment to the next waypoint when navigating routes.

The ENTER key is used to confirm data entry into the Pilot GPS, or to activate certain editing functions.



# How To Use the Pilot GPS

## Getting Started

Check to see that all the components shown on Page 6 were included with your Pilot GPS. If a part is missing, contact the Interphase Customer Service Department (408) 426-2007 as soon as possible.

**WARNING:** DO NOT operate the Pilot GPS with parts missing or with parts other than those obtained through Interphase; doing so could cause major navigational errors. Any malfunctions to the Pilot GPS resulting from unauthorized parts may not be covered by warranty.

## Turning the Pilot GPS On

To turn the Pilot GPS on, slide the power switch located on the lower right corner of the unit to the ON position. The Pilot GPS should respond with a BEEP and, after performing a brief SELF-TEST of the receiver, the display will show:



SEARCH  
0 SATS

That's all you need to do! The Pilot GPS is completely automatic upon turn on, and you should be "locked on" to satellite signals in just a few minutes. If you wish to speed things up for a first time turn on, see Special 01, Initialization, on Page 26.

Upon "locking-on" to 3 or more satellites, the Pilot GPS will automatically display the current latitude and longitude position. If fixes are lost for more than 10 seconds, the display will alternate showing the last known position coordinates and "not Current". This is a warning that the Pilot GPS is not ready to use for navigation. To silence the "not Current" beeper, press the STATUS key.

## What Is a Waypoint?

A Waypoint is usually a starting point, destination, buoy or channel marker, or any place you wish the Pilot GPS to remember. For fishing it is usually a favorite fishing spot, harbor entrance, location of a reef, rocks or other important bottom structure.

The Pilot GPS stores up to 100 Waypoint positions numbered 00 to 99, however location 00, 98 and 99 have special functions. Location 00 is used by the Pilot GPS for making calculations from your starting position, 98 is used for the Man Overboard (MOB) location and 99 is usually reserved for your "Home" location as described later in this manual.

Waypoints can be stored using either of two methods. You can INSTANTLY store your boat's present position, or you can enter the Latitude/Longitude of any position you want using the KEYBOARD entry. If you are planning on storing Loran C TD coordinates as a Waypoint, see Page 23.

## Instant Waypoint Entry

The easiest and most accurate means of storing a Waypoint in the Pilot GPS is to:

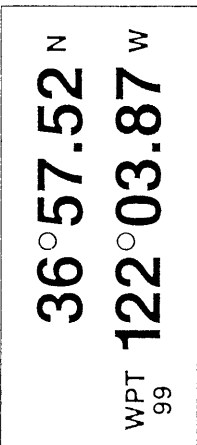
Press the SAVE key. The Pilot GPS will respond with the following display:



SAVE in  
no. 99



You will note that the first digit of the TWO DIGIT Waypoint number is blinking. Using the keypad put in the first digit of the desired Waypoint number. Next, with the second digit blinking, put in the desired number. If both digits are correct, press ENTER. The Pilot GPS will then display the position coordinates and, in the bottom left of the display, show the TWO DIGIT number of the Waypoint just stored.



36° 57.52 N  
WPT 122° 03.87 W  
99

You can now press any function key to return to other operation.

## Waypoint Entry by Keyboard (Or to Change a Waypoint)

(For TD Waypoint Entry, see Page 23). If you know the Latitude/Longitude of a position you wish to store as a Waypoint, or you wish to change a Waypoint to different coordinates, you can do a KEYBOARD entry as follows:

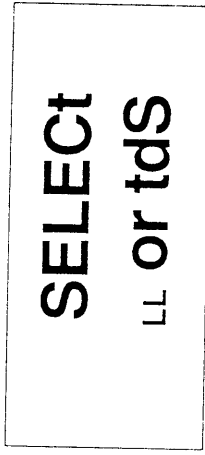
Press the WPT key. The Pilot GPS will then display:



DISPLAY  
no. 99



Enter in a TWO DIGIT number for the Waypoint memory location. Press ENTER, and the Pilot GPS display will show the coordinates that are currently in the selected Waypoint memory location. If you wish to change the coordinates, press the CHANGE key. The Pilot GPS display will show:



Press the LAT/LON key. Enter the Latitude coordinates for the top line. After the last Latitude digit has been entered, use the ALT key to select the flashing N or S, for North or South, then press ENTER. Next, use the ALT key to select the flashing W or E, for West or East, then press ENTER. Now enter the Longitude coordinates (remember the leading "0" if less than 100 degrees). After the last Longitude digit has been entered, press ENTER.

The Pilot GPS display will show the position coordinates and in the bottom left of the display is the TWO DIGIT Waypoint number where they are now stored. It is recommended to keep a written log of your Waypoint positions for future use.

Push any function key to return to other operations.

### Storing a "Home" Location

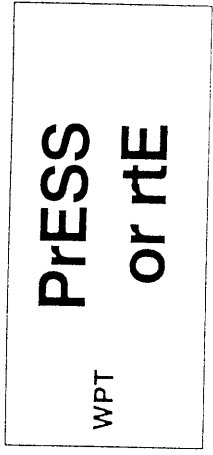
The Pilot GPS uses Waypoint #99 as a special "Home" location. It is recommended to save this Waypoint for a special position, such as the entrance to your home harbor channel or an important navigational buoy. The best procedure is to actually be at the location you wish to store for "Home", and use the INSTANT ENTRY method previously described in this section of the manual.

By doing this simple "Home" location procedure, the Pilot GPS will always be ready to give you all the navigational information you need to get back "Home" with the single press of the HOME key.

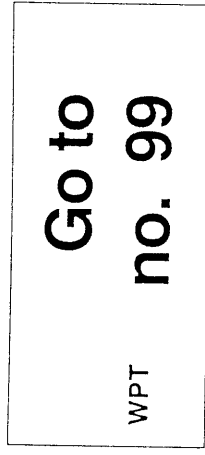
### Going to a Waypoint

The Pilot GPS has been designed to be an easy to use GPS receiver. Follow these few simple steps to go to a waypoint:

First, press the GO TO key. The Pilot GPS display will respond:



In this example we want to navigate to a Waypoint (for Routes see the section later in this manual). Push the WPT key. The Pilot GPS is always navigating to a Waypoint, even in the background if you are using other displays. The display will now show you the current Waypoint destination.



If you wish to continue going to the current Waypoint, press ENTER twice, then press the NAV key. If you want to navigate to a new Waypoint, simply enter the TWO DIGIT Waypoint number, then press ENTER. That's all there is to it! The Pilot GPS will show you the navigational information to steer from your boat's present position to the Waypoint.

Annotations for the display:

- Off course (to get back on course): NM OFF RIGHT
- Nautical miles off course: 0.03
- Direction to steer: 326°
- Waypoint being used: WPT 99
- Present speed in knots (averaged over last several minutes): 5.6 SPEED
- Speed—Decimal readings under 10 knots only
- Miles—Decimal readings in 1/100's under 100 nautical miles: 0.06 MILES
- Compass course to steer to reach Waypoint 99
- Distance in nautical miles from current position to Waypoint 99

Use your ship's compass to steer to the Waypoint. It is important that you have your ship's compass compensated for your area's magnetic variation to be accurate. The Pilot GPS will let you know of any changes that develop to the proper course. The Direction To Steer Arrow will show you what direction to steer if you are off the straight line course from your starting point to the destination Waypoint. For example, if you are off to the right side of the course line, the Arrow will point to the left to get you back on track (and vice versa). Fine tune your steering by observing the Miles Off Course displayed above the steering arrow. Steer a slight amount for a small distance off course, and a larger amount for a further distance off course. If the Off Course distance seems too large, or the Arrow direction seems confusing, repeat the GO TO and NAV procedure to plot a new course line from your current position. To silence the Waypoint Arrival Alarm, press any key.

# Pilot GPS Displays

## LAT/LON Key

Press the LAT/LON key to bring up the Position screen in Latitude and Longitude coordinates.



36°57.52 N  
122°03.87 W

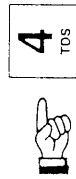
When you press the LAT/LON key, all displays of position, including waypoints, are shown in Latitude and Longitude. All entries of waypoints are done in Latitude and Longitude. The LAT/LON mode is maintained until the TDs key is pressed.

If the Pilot GPS loses its lock on satellite signals for more than 10 seconds, the display will alternate showing the last known Latitude and Longitude coordinates and "not Current".

**WARNING:** You cannot rely on the Pilot GPS position information when the display shows "not Current".

## TDs Key

When you press the TDs key, all displays of position, including waypoints, are shown in Loran C TD coordinates. Successive presses of the TDs key will rotate through the various combinations of TDs that could be used for the displayed position. If the position displayed or stored is outside of Loran C coverage, the Pilot GPS will not show TDs. The TD mode is maintained until the Lat/Lon key is pressed.



27433.1 TD1  
42883.0 TD2

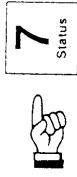
If the Pilot GPS loses its lock on satellite signals for more than 10 seconds, the display will alternate showing the last known position coordinates and "not Current".

**WARNING:** You cannot rely on the Pilot GPS position information when the display shows "not Current".

See Page 23 for more details on TD coordinates.

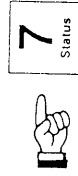
## STATUS Key

Press the STATUS key and the Pilot GPS will show how many satellites it has locked on to:



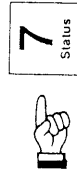
GOOD  
4 SATs

Upon turn on, the Pilot GPS starts searching for satellites and the above display will first show "SEARCH 0 SATs", then progress to "SEARCH 1 SAT", "SEARCH 2 SATs" and finally display "GOOD 3 SATs" or "GOOD 4 SATs" upon locking on to the necessary 3 or 4 satellites to obtain a position fix. Press the STATUS key again to see the time of the Last Good Fix:



17:58 - 25  
LSt POS

The above display of time of Last Good Fix (Position) uses a 24 hour clock. You need to enter your time zone offset (see Special 01, Page 27) in order to read local time. Pressing the STATUS key a third time displays the Loran C GRI chain which is being used for your current position (if applicable).

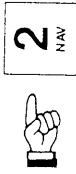


Gri  
9940

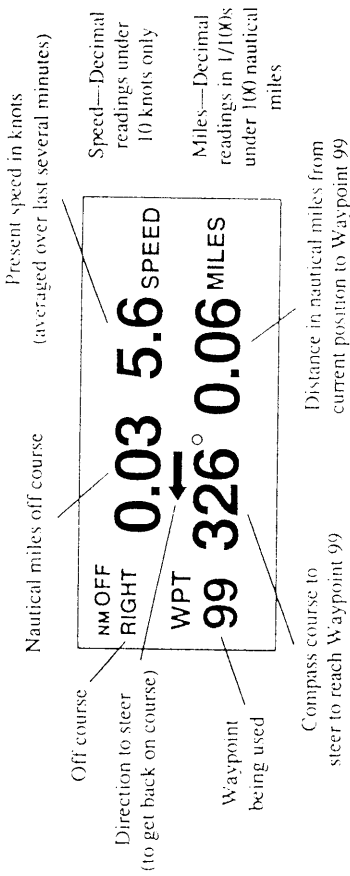
You can rotate back to the first STATUS screen by pushing the STATUS key again, or you can push any key to go to another function.

## NAV Key

Pressing the NAV key displays the basic navigational screens of the Pilot GPS. The navigation screens provide all the information you need to reach your destination Waypoint with great accuracy. Press the NAV key one time and the Pilot GPS will show:

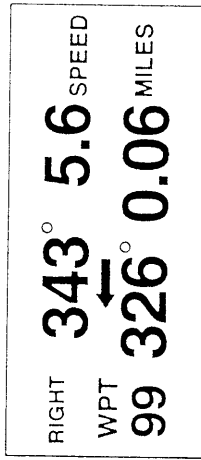
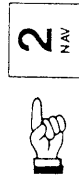






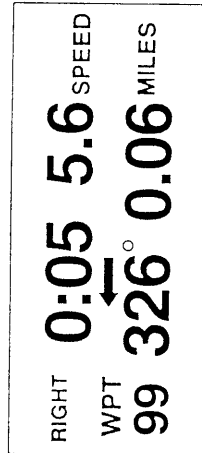
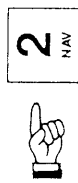
This screen is probably the most used navigation display, providing the course to steer and distance to the Waypoint destination (chosen with the GO TO key). The distance reads in 1/100's of a nautical mile under 100 miles. You will also note the Miles Off Course (Cross Track Error) in the upper left. The Speed shown is based on an average over several minutes.

Press the NAV key again and the display will show COURSE OVER GROUND (COG).



This display shows the average track (the direction the boat has been travelling), the current boat speed, magnetic bearing to the destination, and the current distance to the destination. Data displayed is averaged over several minutes. You will notice that the COG bearings in the upper left of the display will be interrupted occasionally to flash "COG".

Press the NAV key again and the display will show TIME TO GO (TTG).

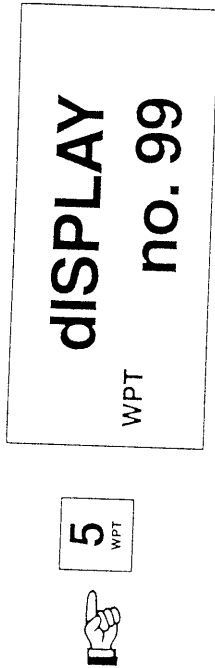


This display tells you how long it will take to get to your selected Waypoint, the average speed at which you are travelling, your compass bearing to the destination, and the distance to the destination. Data displayed is averaged over several minutes. You will notice TTG readings in the upper left of the display will be interrupted occasionally to flash "TTG".

You may switch between the three navigational displays by alternate pressing of the NAV key. Press any other function key to exit the navigational displays.

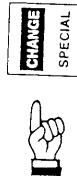
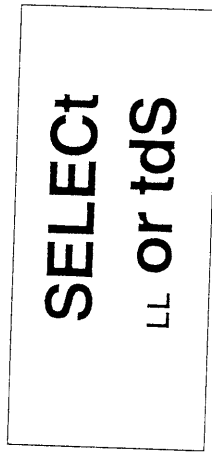
### WPT Key

The Pilot GPS is capable of storing up to 100 Waypoints. To view or edit Waypoints, press the WPT key. The Pilot GPS will show:

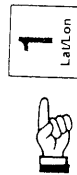
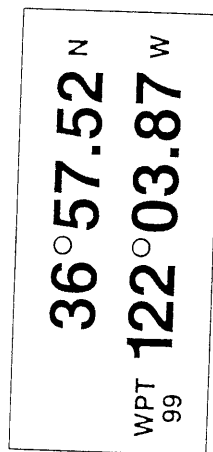


Enter in a TWO DIGIT number for the Waypoint memory location, then press ENTER. The Pilot GPS will display the Latitude/Longitude coordinates currently stored in the selected Waypoint memory location. If you wish to leave the coordinates as they are, push any function key to return to other operations.

To edit or create a new Waypoint press the CHANGE key. The Pilot GPS will show:



To edit the Waypoint using LATITUDE/LONGITUDE coordinates, press the LAT/LON key. The Pilot GPS will display:





Type in the Latitude coordinates on the top line. Use the ALT key to select N or S, then press ENTER. Use the ALT key to select W or E, then press ENTER. Type in the Longitude coordinates on the bottom line, then press ENTER. Press any function key to go to other operation.

To edit the Waypoint using Loran C/TD coordinates, please refer to Page 23.

## RTE Key

Once you have Waypoints stored in the Pilot GPS, you can create ROUTES. The Pilot GPS can store up to 10 individual Routes of 16 Waypoints each. To view or edit Routes, press the RTE key. The Pilot GPS will show:

**Enter**  
**route 1**



Routes are numbered 0 thru 9. Enter any number 0 thru 9, then press ENTER. The Pilot GPS will display:

**route 1**  
**Pt 1 01**

Type in the TWO DIGIT Waypoint number you wish to store as the first in your Route, then press ENTER. If you do not wish to change the first Waypoint of the Route, or you are just reviewing the Waypoints of the Route, press ENTER twice. Repeat this procedure for successive Waypoint entries for your Route. To end a Route of less than 16 waypoints, after you have entered the last waypoint, put in WPT 00 as the final point. Press ENTER and the Route will be completed. Press any key to exit the Route mode.

## GO TO Key

To start navigating to a Waypoint or Route, press the GO TO key. The Pilot GPS will show:

**PRESS**  
**or rTE**

To navigate to a WAYPOINT, press the WPT key. The Pilot GPS will display the current Waypoint destination it is navigating to. Type in the TWO DIGIT number of the new Waypoint destination, then press ENTER. The Pilot GPS will start navigating to the new Waypoint destination. To silence the Waypoint Arrival Alarm, press any key.



To start navigating a ROUTE, press the RTE key. The Pilot GPS will display the last Route it has navigated. Type in the Route number, 0 thru 9, that you wish to start navigating, then press ENTER.

The Pilot GPS will now ask you whether you wish to navigate the Route in forward or reverse order. Press the appropriate key, and you will start navigating to the first Waypoint in the Route order. You will note that the route waypoint destination is flashing in the lower left of the display. If you wish to skip a Waypoint in the Route and go to the next one, press the NEXT key.

To stop navigating a Route, press GO TO and select a new destination.

## HOME Key

The Pilot GPS uses Waypoint #99 as a special "Home" location. You must have this special location previously stored in Waypoint #99 in order to use this handy feature. When you are done boating or fishing for the day, press the HOME key. The Pilot GPS will show:



NM OFF  
RIGHT  
WPT  
**99 326° 0.06 MILES**  
**0.05 5.6 SPEED**

With the simple press of one button, the Pilot GPS is navigating back to your "Home" location and displaying all the navigational information you need. To silence the "Home" Waypoint Arrival Alarm, press any key.

To exit the "Home" navigation mode, press the GO TO key to choose a new Waypoint destination.

## MOB Key

In an emergency, such as "Man Overboard" (MOB), you can instantly store and navigate to the position of concern. Press the MOB key, and the Pilot GPS will sound an alarm while showing "OVERBOARD", then display:

NM OFF  
RIGHT  
WPT  
**98 326° 0.04 MILES**  
**0.02 5.6 SPEED**

You will note that all the navigational information you need to return immediately to the location where you pressed the MOB key is displayed, down to 1/100th of a mile. As an added safety feature, if the keyboard is accidentally bumped to cause the Pilot GPS to exit the Navigation screen during an emergency such as Man Overboard, simply press the NAV key. You will note that you are still navigating to the Man Overboard position. The MOB location was automatically stored as Waypoint #98 when you pressed the MOB key. To silence the MOB Alarm, press any key.

To exit the MOB navigation mode, press GO TO and select a new Waypoint destination.

# The Basics of GPS

GPS, or Global Positioning System, is a satellite navigation system designed to provide worldwide positioning and time information with all weather capability, quick response time and accuracy to within several yards. GPS is maintained by the United States Department of Defense 24 hours a day.

GPS is a system of 24 satellites orbiting at an altitude very high above the earth. Because of the great altitude, the satellites' signals are not interfered with by the terrain or geography, and the high frequency of the signals (1575 MHz) results in practically no interference from shipboard engines or other electronic systems.

GPS uses the principle of ranging to give you your position. This is done by measuring the distance from your present position to the position of at least three satellites. The distance to a satellite is calculated by measuring how long it takes radio signals to arrive from the known position of each of the respective satellites in their orbits.

The satellites and the **Pilot GPS** must be precisely timed to generate the exact same radio signal at the exact same time in order to measure the time and distance calculations with a high degree of accuracy. This is accomplished by the use of atomic clocks on all the satellites, and by comparing what part of the radio signal code is received at the exact same time from all the satellites.

To complete its calculations for your position, the **Pilot GPS** looks up in its data base the known position of each satellite at that exact time. Because the GPS satellites are in such a high orbit, their positions at any given time are quite predictable. Now, all the **Pilot GPS** needs to do is calculate all this data for three or four satellites every few seconds, and you have continuous position updating!

GPS satellites are constantly monitored by Department of Defense ground stations. Satellite clocks and exact positioning information are computed and any variations are noted or corrected as necessary, and transmitted to the appropriate satellites.

**WARNING:** While the GPS satellite constellation is considered fully implemented, its status is still considered as experimental. Users are cautioned that the system may be turned off or satellites moved at any time, without warning. **DO NOT** place yourself or your vessel in a situation where GPS is your sole means of navigation. Check with the Coast Guard for current operational status and messages.

**WARNING:** Selective Availability (SA) has been implemented by the U.S. DoD to restrict the accuracy of GPS positions. The accuracy of the GPS system is such that 95% of the time a fix will be within 100 meters of the actual geographic position.

## Differential GPS Made Simple

The basic GPS system has proven to be quite accurate for most boaters. There are some who desire, and some who require, even better accuracy. There are inherent errors with the GPS system that could not be avoided, such as atmospheric distortions, satellite atomic clock errors and reflected signals, called multipath error. These factors together could account for up to 15 to 20 meter accuracy error. The biggest error factor with the basic GPS system is the intentional source of Selective Availability, or SA, which the U.S. Department of Defense has installed so that no hostile force can use the accuracy of GPS against the U.S. or its allies. Now we're looking at potential errors of up to 100 meters. This was born the move towards differential GPS, or DGPS.

Differential GPS is a system of land based GPS receiving stations located at positions that have been very accurately surveyed. The reference GPS station receives the satellite signals, compares the position the satellites have given it with its known surveyed position and computes the difference. This difference is then transmitted via radio beacons from the land based reference station to all DGPS receivers within its range. Accuracy to about five meters is common when close in range to the GPS reference station.

DGPS requires that you have a special receiver connected to the **Pilot GPS**. This DGPS Beacon Receiver uses an antenna to receive the radio signals from the local GPS reference station, computes the corrections and relays them to the **Pilot GPS**. There are several manufacturers of DGPS Beacon Receivers which can interface to the **Pilot GPS**. Please contact **Interphase Customer Service**, (408) 426-2007 for details.

The U.S. Coast Guard DGPS beacons are scheduled to be fully operational in 1996. These Coast Guard DGPS broadcast areas are along coastal areas near harbors, the Great Lakes area and will include Hawaii and Puerto Rico. For inland areas not covered by marine beacons, use of private DGPS systems broadcast over FM radio frequencies are available. There are also some other countries in the planning stage to include DGPS coverage for their waters.

# Advanced Navigation Guide

The Pilot GPS is designed to be the easiest to use GPS system available today. The previous sections of the operation manual have detailed the basics of installation and operation of the Pilot GPS. To utilize the system to its optimum, the following section on navigation should be studied. By becoming familiar with these navigational terms and concepts, you will increase your own navigational skills.

## NAVIGATIONAL TERMS—

**LATITUDE/LONGITUDE (LAT/LON)** Latitude is the distance measured in degrees North and South of the equator. Longitude is the distance measured in degrees West and East of the prime meridian at Greenwich, England.

**SPEED OVER GROUND (SOG)** This is the true speed calculated from the time and distance over the ground you have travelled. SOG does not consider water speed or destination for its calculation.

**COURSE OVER GROUND (COG)** This is the true course over the ground on which you are currently heading.

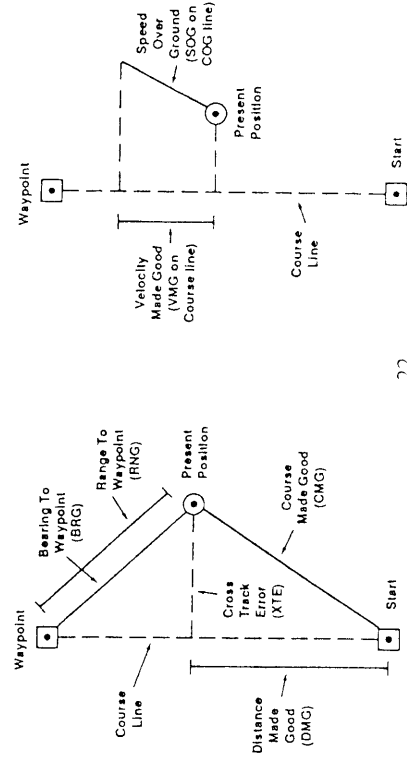
**CROSS TRACK ERROR (XTE)** This is the distance of your boat, either left or right, from the desired track (start point to destination).

**RANGE (RNG)** Distance from present position to the selected waypoint.

**BEARING (BRG)** Angle from magnetic North to the waypoint at present position.

**TIME TO GO (TTG)** This is calculated from the current distance to go (DTG) to your destination and your VELOCITY MADE GOOD (VMG) of how long it will take you to get to your selected waypoint.

**VELOCITY MADE GOOD (VMG)** This is the portion of your boat's speed that is parallel to your desired track (start point to destination). VMG is especially useful for sailing boats where closing speed on the desired waypoint is displayed regardless of course or bearing changes (tacking) made enroute.

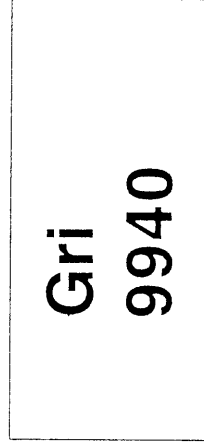
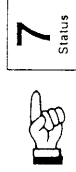


# Using TDs With the Pilot GPS

Although the Pilot GPS is calculating positions from satellite signals in Latitude and Longitude, you can instantly convert your current position, or Waypoint positions, to Loran C TD coordinates with the push of one button. (If you are in a location not covered by Loran C, the Pilot GPS will not display TDs).

You can easily store TDs in Waypoints for any of the Loran C GRIs in the Pilot GPS, even if you are thousands of miles away. Or, if you are operating the Pilot GPS in an area with overlapping GRIs, you can simply select whichever GRI you want it to use.

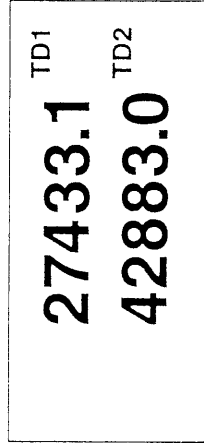
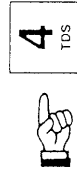
To check which GRI was last used by the Pilot GPS, press the STATUS key three times.



If you want to use TDs that are in a different GRI, enter SPECIAL 10. When the Pilot GPS displays the GRI you wish to use, press ENTER. You can now press any function key to go to other operations. The Pilot GPS is now calculating TD positions for the GRI you have selected.

## Current Position in TDs

To view your current position in TDs, press the TDs key. The Pilot GPS will show:

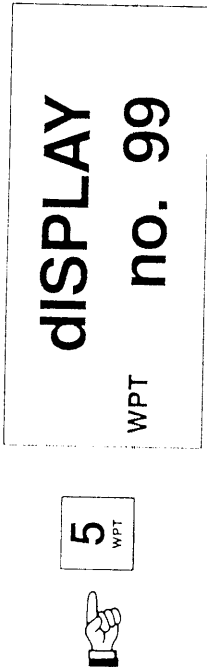


Alternate pressing the TDs key to display any remaining TDs that can be used for your current position. There may be 0, 1, 2 or 3 additional TDs depending on which Loran C GRI you are operating in.

## Storing Waypoints Using TDs

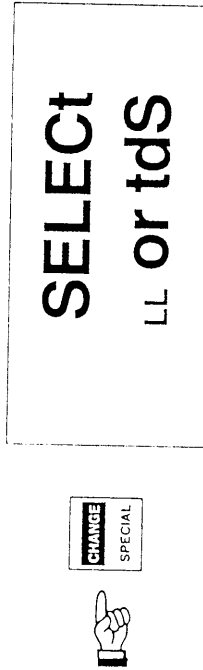
You can store TDs into Waypoints by following these simple steps:

Press the **WPT** key. The **Pilot GPS** will show:

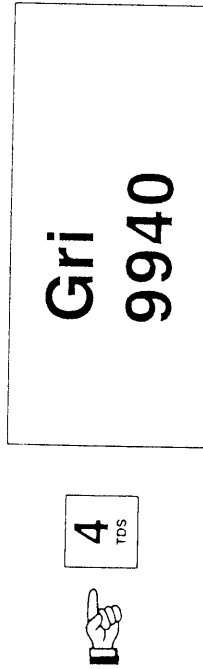


Enter in a **TWO DIGIT** number for the Waypoint memory location, then press **ENTER**. The **Pilot GPS** will display the coordinates currently stored in the selected Waypoint.

If you wish to leave the Waypoint coordinates as they are, push any function key to return to other operations. To edit or create a new Waypoint press the **CHANGE** key. The **Pilot GPS** will show:

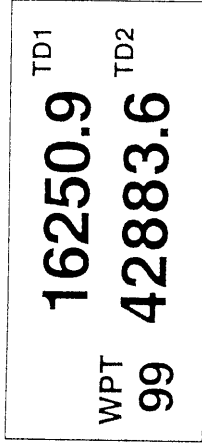


To edit or create a new Waypoint using TD coordinates, press the **TDs** key. The **Pilot GPS** will display:



Whichever Loran C **GRI** is current or is already used for that Waypoint will be flashing (or "no Gri" if the Waypoint location is outside of Loran C coverage areas). If the **GRI** is correct for the **TDs** you wish to store, press **ENTER**.

If you want to store **TDs** which are outside of your current **GRI** area, press **CHANGE**. The **Pilot GPS** will rotate displays of all Loran C **GRI**s it is programmed for. When you see the desired **GRI** displayed, press **ENTER**. The **Pilot GPS** will show:



Type in the two **TD** coordinates you wish to store. After entering the last digit of the bottom line, press **ENTER**.

**NOTE:** There could be some problems trying to use the 11 **TD** for locations near the Texas and Louisiana coast, and the 43 **TD** near West Palm Beach, Florida. This is due to proximity to the Loran C base line extension of these **TD** stations.

Press any function key to return to other operations (or push the **LAT/LON** key twice to return to the current **LAT/LON** position screen).

## Displaying TDs from Waypoints

If you wish to view the Loran C **TD** coordinates from a Waypoint memory location, first press the **WPT** key. Enter in a **TWO DIGIT** number for the desired Waypoint, then press **ENTER**.

The **Pilot GPS** will display the Latitude/Longitude coordinates stored for that Waypoint memory location. Press the **TDs** key to view the **TD** coordinates for the Waypoint. Alternate pressing the **TDs** key to display any remaining **TDs** for that Waypoint location.

## Special Features

The **SPECIAL** key allows you to use additional features of the **Pilot GPS**. Use these Special features only after a careful reading of this section of the manual, since some of the Special functions, if incorrectly executed, could result in navigational errors.

### Special 00 - Backlight On/Off

Enter a **SPECIAL** (0) to turn the display backlight On or Off. This Special functions as a "Foglight Switch"; that is, it alternates turning the backlight On and Off.

### Special 01 - Initialize

For first time turn on, if you have moved more than 100 miles from the last start up location, or if it has been over one week since you last started the **Pilot GPS**, you can greatly improve the acquisition time of locking on to satellite signals by using **SPECIAL 01**. Refer to Time Zone Offsets and Start Up Locations, Page 35, to complete this Special.

Press the **SPECIAL** key, type in 01, then press **ENTER**. The **Pilot GPS** display will show:

**HOURS  
OFF 00**

Put in the time offset for your location, then press **ENTER**. Press **Key 1** for **PLUS** or **Key 4** for **NEG** to select + or - hours. If you only wish to change your Time Offset, you may now press **Key 1** to indicate **DONE**. The **Pilot GPS** will display the Time Offset you have just entered. Press any other function key to go to other operations. To continue with the Initialization, press **Key 4**. The **Pilot GPS** will now show:

**36° 57.52 N  
122° 03.87 W**

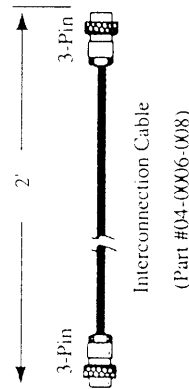
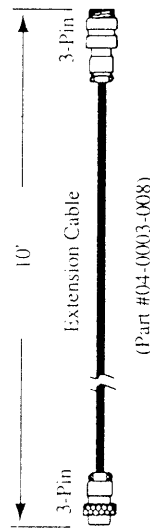
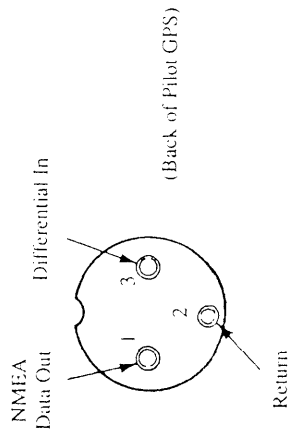
## DGPS & NMEA 0183 Interface

### DGPS Data Input

The **Pilot GPS** is completely ready to process DGPS data from most DGPS Beacon Receivers which output the industry standard RTCM SC104 format at a rate of 9600 Baud. Connect the DGPS data input to Pin 3, with return to Pin 2.

### NMEA 0183 Data Output

The **Pilot GPS** outputs the industry standard NMEA 0183 format at a rate of 4800 Baud. This serial data output can provide GPS data to some autopilots, track plotters or fishfinders. The NMEA 0183 GPS data outputs from Pin 1, with return to Pin 2.



The NMEA 0183 data sentences are as follows:

\$GPRMC,224317,A,3657.55,N,12203.80,W,0.0,1.325,140591,15.5,E,7A  
 \$GPRMB,A,0.02,R,STRT,WEST,3657.54,N,12303.80,W,047.9,270,00.1,V,01  
 \$GPGLL,3657.55,N,12203.80,W  
 \$GPBWC,224317,3657.54,N,12303.80,W,270,T,255,M,047.9,N,WEST  
 \$GPVTG,325,T,309,M,00.1,N,00.2,K  
 \$GPAPA,A,0.02,R,N,V,255,M,WEST  
 \$GPAPB,A,0.02,R,N,V,255,M,WEST,255,M,

Enter the digits for Latitude. After the last digit of Latitude is entered, use the **ALT** key to select N for North or S for South, as appropriate, then press **ENTER**. Next, use the **ALT** key to select W for West or E for East, as appropriate, and again press **ENTER**. Now you enter the digits for Longitude (remember the leading "0" if less than 100 degrees Longitude). After you enter the last digit of Longitude, press **ENTER**. The **Pilot GPS** will show:

**18:03**  
**05-15-93**

Enter the approximate local time (24 hour clock). Next, enter the digits for the month, day and year. The **Pilot GPS** is now initialized. Press the **STATUS** key and you can see how the receiver is doing as it searches for and locks on to satellites. You should typically be locked on to signals and see a **GOOD** message within three minutes of initialization.

### Special 02 - View Time and Date

If you have entered your Time Offset (see Special 01), you can use **SPECIAL 02** to view a display of the current local time (24 hour clock) and date. This is very accurate data provided from the **GPS** satellites.

### Special 03 - Anchor Watch

**Special 03**, called **Anchor Watch**, reports when your boat has drifted outside an imaginary circle surrounding your anchor Waypoint. When you release the anchor, press the **SAVE** key and select a Waypoint number for your anchoring position. Next, when you select **SPECIAL 03**, the **Pilot GPS** will first ask you for an anchor Waypoint, the display showing:

**AnCHOR**  
WPT **no. 00**

Enter the Waypoint number you have saved for your anchoring position. The **Pilot GPS** will ask for an "anchor distance", the display showing:

**AnCHOR**  
**dist = 0.20**

Put in any distance between 0.01 and 0.99 nautical mile, then press **ENTER**. If your boat drifts beyond this distance from your anchor Waypoint, the unit will beep to alarm you. To silence the alarm and exit the **Anchor Watch**, press the **GO TO** key and select a new destination.

### Special 04 - Arrival Alarm

This **Special** is used to set the arrival alarm distance from Waypoints. This distance represents the radius of an imaginary circle around the destination Waypoint. Upon entering this **Special**, the display will show:

**ArrIVAL**  
**dist = 0.20**

Put in an arrival distance between 0.01 and 0.99 nautical mile, then press **ENTER**. Upon arriving within this distance from a destination Waypoint, the **Pilot GPS** will start beeping to alarm you. To silence the alarm, press any key.

### Special 05 - Display Altitude

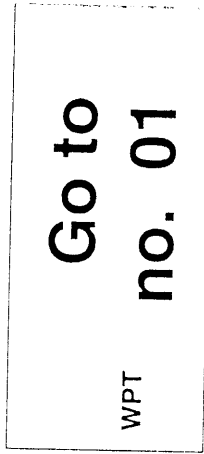
This **Special** displays your current position's approximate altitude in feet. This calculation can only be made when the **Pilot GPS** has locked on to four satellites. This is the most difficult position calculation for any **GPS** receiver to make, and you can expect considerable fluctuations from surveyed altitudes.

### Special 06 - Navigation Calculator

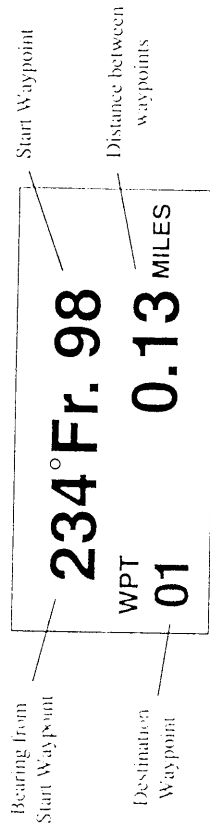
This is a convenient reference **Special** which calculates the True compass bearing and distance between any two Waypoints stored in the **Pilot GPS** memory. Press **SPECIAL 06**, then **ENTER**. The **Pilot GPS** shows:

**StArt**  
WPT **no. 00**

Put in your Start Waypoint, then press ENTER. The display will then ask:



Put in the Waypoint number you wish to Go To, then press ENTER. The display will now show:



The information displayed on the top line gives you the True bearing Fr. (From) the Start Waypoint. In the lower left is the destination Waypoint you are Going To, followed by the distance in nautical miles between the two Waypoints.

**NOTE:** The bearing is given in TRUE degrees, not MAGNETIC. Add or subtract magnetic variance to calculate the Magnetic course between the Waypoints.

### Special 07 - Display Speed as VMG

The Pilot GPS normally expresses the speed shown in the navigation displays as Speed Over Ground (SOG). As an alternative, you may display speed in terms of Velocity Made Good (VMG), also known as Course Speed. SPECIAL 07 allows you to determine which speed mode is currently being used. Either displayed speed is in knots and is averaged over a few minutes. Most boaters will want to use Ground Speed. VMG is especially for sailing boats to indicate closing speed on the desired waypoint regardless of course or bearing changes (tacking) made enroute. The Pilot GPS defaults to SOG upon turning Off and back On.

### Special 08 - Magnetic Variance

By selecting SPECIAL 08 you are requesting that the Pilot GPS display the magnetic variation for your present position.

### Special 09 - Differential On/Off

Enter a SPECIAL 09 to select Differential GPS processing or regular GPS processing. If you select differential GPS, you must then turn the unit Off and back On in order to change back to regular GPS. The use of this Special is dependent upon having a Differential Beacon Receiver properly hooked up to the Pilot GPS. Call Interphase Customer Service (408) 426-2007 for further details.

### Special 10 - GRI Selection

This Special allows you to select which Loran-C GRI is to be used by the Pilot GPS for its Latitude/Longitude to TDs conversions. If you wish to view which GRI the Pilot GPS is currently using, use the STATUS key as described earlier in the manual.

### Special 11 - Display Software Version

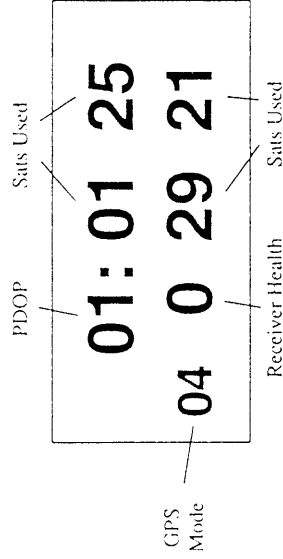
This Special displays the software versions of your Pilot GPS. The top line, "GPS", is for the receiver. The bottom line, "C-d", is for the operations software of the control display. For service calls it can be helpful to have this information ready.

### Special 12 - Change Starting Waypoint

When you start navigating to a new destination Waypoint, the Pilot GPS automatically designates your current position as Waypoint 00, the starting point of your course line. By using SPECIAL 12, you can designate any previously stored Waypoint as the starting point of your course line.

### Special 13 - Satellite Information

SPECIAL 13 provides status information monitoring the success of satellite acquisition. A typical display may show:



PDOP stands for Position Dilution Of Precision. The lower the rating the better your position fix. Above 12 is not usable. A PDOP of 00 means no satellites are currently being tracked, 0-03 is excellent, 04-06 good, 07-09 acceptable, 10-12 marginal and above 12 unacceptable.

The satellites being used by the Pilot GPS are identified by their respective satellite numbers.

GPS Mode pertains to the functioning condition of the receiver, and is displayed as follows:

- 00 = no satellites being tracked
- 01 = 1 satellite tracked (this is enough to provide time)
- 03 = 3 satellites tracked (minimum for 2D position fix)
- 04 = 4 satellites tracked (3D position fix; includes altitude)

Health of the receiver is information of current status on efforts to get signals from the satellites.



Receiver health is coded as follows:

- 0 = doing position fixes (good)
- 1 = no GPS Time yet
- 3 = PDOP is above 12 (not usable for fixes)
- 8 = no usable satellites
- 9 = 1 usable satellite
- A = 2 usable satellites
- B = 3 usable satellites.

A typical Health sequence upon start up would be 1, 9, A, 0.

### Special 14 - Select Map Datum

SPECIAL 14 is used to select which map datum the Pilot GPS is to reference when calculating position fixes. The default datum is 000 (WGS-84; World Geodetic Survey-1984), which is the most recent world wide survey. Since some charts around the world may reference other local geodetic surveys, the Pilot GPS allows you to select from 181 map datums.

**WARNING:** The map datum selected is stored in the Pilot GPS memory. You must do SPECIAL 14 again to change it. Considerable navigational errors may result from using the wrong datum.

This list provides the number code to enter for each of the 181 map datums available:

#### Master Datum List

Number	Map Datum	Number	Map Datum
000	WGS-84 (default)	023	Arc 1950-Mean
001	Tokyo	024	Arc 1950-Boiswana
002	NAD-27	025	Arc 1950-Lesotho
003	Alaska/Canada	026	Arc 1950-Malawi
004	European	027	Arc 1950-Swaziland
005	Australian	028	Arc 1950-Zaire
006	WGS-72	029	Arc 1950-Zambia
007	NAD-83	030	Arc 1950-Zimbabwe
008	NAD-02	031	Arc 1960-Mean
009	Mexican	032	Arc 1960-Kenya
010	Hawaiian	033	Arc 1960-Tanzania
011	Astronomic	034	Ascension Is. 1958
012	U.S.Navy	035	Astro Beacon E 1945
013	European	036	Astro B4 Sorol Atoll
014	Australian 1984	037	Astro Pos 71/4
015	Adindan-Mean	038	Astro Station 1952
016	Adindan-Ethiopia	039	Australian Geo 1966
017	Adindan-Mali	040	Bellevue (IGN)
018	Adindan-Senegal	041	Bermuda 1957
019	Adindan-Sudan	042	Bogota Observatory
020	Algooye-Somalia	043	Compo Inchauspe
021	Ain El Abd-Bahrain	044	Canton Island 1966
022	Anna I Astro 1965	045	Cape-South Africa

Number	Map Datum	Number	Map Datum
046	Cape Canaveral-Mean	093	Nahrwan-Saudi
047	Carthage-Tunisia	094	Namibia
048	Chatham 1971	095	Naparima-BWI
049	Chua Astro-Paraguay	096	NAD 27-Western US
050	Corrego Alegre-Brazil	097	NAD 27-Eastern US
051	Djakarta-Batavia	098	NAD 27-Alaska
052	DOS 1968, Gizo I	099	NAD 27-Bahamas
053	Easter Island 1967	100	NAD 27-San Salvador
054	Euro 1950-Mean	101	NAD 27-Canada
055	Euro 1950-Cyprus	102	NAD 27-Alberta/BC
056	Euro 1950-Egypt	103	NAD 27-East Canada
057	Euro 1950-Eng/Scot	104	NAD 27-Manitoba/Ont
058	Euro 1950-Eng/Ire	105	NAD 27-NW Ter/Sask
059	Euro 1950-Greece	106	NAD 27-Yukon
060	Euro 1950-Iran	107	NAD 27-Canal Zone
061	Euro 1950-Sardinia	108	NAD 27-Caribbean
062	Euro 1950-Sicily	109	NAD 27-Central Amer
063	Euro 1950-Norway	110	NAD 27-Cuba
064	Euro 1950-Port/Spain	111	NAD 27-Greenland
065	European 1979	112	NAD 27-Mexico
066	Gandajika Base-Maldives	113	NAD 83-Alaska
067	Geodetic Datum 1949	114	NAD 83-Canada
	New Zealand	115	NAD 83-CONUS
068	Guam 1963	116	NAD 83-Mex/Cent Am
069	GUXI Astro Guad.	117	Observatorio 1966
070	Hjorsey 1955-Iceland	118	Old Egyptian 1907
071	Hong Kong 1963	119	Old Hawaiian-Mean
072	Indian-Thai/Viet	120	Old Hawaiian-Hawaii
073	Indian-India/Nepal	121	Old Hawaiian-Kauai
074	Ireland 1965	122	Old Hawaiian-Maui
075	ISTS 073 Astro 1969	123	Old Hawaiian-Oahu
076	Johnston Island 1961	124	Oman
077	Kandawala-Sri Lanka	125	Ord Sur Brit 1936-Mean
078	Kerguelen Island	126	OSB-England
079	Kertau 1948-Malayan	127	OSB-Isle of Man
080	La Reunion-Masc.	128	OSB-Scotland/Shetland
081	L.C.5 Astro-Cayman Brac.	129	OSB-Wales
082	Liberia 1964	130	Pico De Las Nieves
083	Luzon-Philippines	131	Pitcairn Astro 1967
084	Luzon-Mindanao	132	Prov So Chilean 1963
085	Mahe 1971-Seychelles	133	Prov S American 1956-Mean
086	Marco Astro	134	Prov S American 1956-Bolivia
087	Massawa-Eritrea	135	Prov S American 1956-N Chile
088	Merchich-Morocco	136	Prov S American 1956-S Chile
089	Midway Astro 1961	137	Prov S American 1956-Colombia
090	Minna-Nigeria	138	Prov S American 1956-Ecuador
091	Nahrwan-Masirah	139	Prov S American 1956-Guyana
092	Nahrwan-UAE	140	Prov S American 1956-Peru

## Special 99 - Test Drive/Demo

SPECIAL 99 is a feature of the Pilot GPS which provides GPS navigation instruction and is useful for GPS operation demonstrations. You can also pre-program trips and routes, make navigational calculations of bearing and distance between any Waypoints.

You need not have the antenna connected to use this Special. Press SPECIAL 99, then press ENTER. The Pilot GPS will briefly show "EST Drive", and then will display the Lat/Long position screen. Put in your simulated Latitude and Longitude coordinates. After you put in the last Longitude digit, press ENTER. The Pilot GPS is now in Demo mode.

You can exit the Test Drive/Demo by either entering Special 99 again, or by turning the Pilot GPS off.

## Time Zone Offsets

### Time Zone Offsets & Start Up Locations

In normal operation, your Pilot GPS remembers all of your waypoints and where it was last shut off. When the Pilot GPS is shipped to you all data (including start-up information and waypoints) is erased or in a random condition. Therefore, the first time you turn on the Pilot GPS, it can be helpful to initialize the unit by doing Special 01, then enter a Time Offset and Start Up location to speed up acquisition time of satellite signals.

The internal memory is maintained by a 3V lithium battery, which has a life expectancy of at least five years from date of manufacture. At some future date, the battery will need to be replaced and the memory retention will be good for another five years.

### Time Zone Offsets

Entering a Time Offset will provide you with an accurate display of local time (24 hour clock), as well as speed up your "locking on" to satellite signals. During the Initialization (Special 01), the Pilot GPS will ask for the number of hours, plus or minus, from UTC (Universal Time coordinated), or Greenwich Mean Time. See the below table for U.S. Time Offsets:

<u>Time Zone</u>	<u>Standard Time</u>	<u>Daylight Savings Time</u>
Eastern	-05 Hours	-04 Hours
Central	-06 Hours	-05 Hours
Mountain	-07 Hours	-06 Hours
Pacific	-08 Hours	-07 Hours

Number	Map Datum	Number	Map Datum
141	Prov S American 1956- Venezuela	161	South Asia
142	Puerto Rico	162	Southeast Base
143	Quatar National	163	Southwest Base
144	Quorooq-SO Greenland	164	Timbalai 1948
145	Rome 1980	165	Tokyo-Mean
146	Santa Braz-Azores	166	Tokyo-Korea
147	Santo DOS-Vanuatu	167	Tokyo-Okinawa
148	Sapper Hill 1948	168	Tristan Astro 1968
149	S American 1969-Mean	169	Viti Levu 1916-Fiji
150	S American 1969-Argentina	170	Wake-Eniwetok
151	S American 1969-Bolivia	171	Zanderij-Surinam
152	S American 1969-Brazil	172	Bukit Rimpah
153	S American 1969-Chile	173	Camp Area Astro
154	S American 1969-Columbia	174	Gunung Segara
155	S American 1969-Ecuador	175	Herai North
156	S American 1969-Guyana	176	Hu-Tzu-Shan
157	S American 1969-Paraguay	177	Tanamarive Observ 1925
158	S American 1969-Peru	178	Yacare
159	S American 1969-Triini/Tob	179	Tokyo-GSI coordinates
160	S American 1969-Venezuela	180	RT-90 (Sweden)

## Special 15 - LCD Display Test

SPECIAL 15 allows you to self-test the Pilot GPS LCD display. All digit segments and all characters will be shown. This information may be useful for service calls.

## Special 16 - Display Datum

This Special displays which map datum is currently being used by the Pilot GPS. See Special 14 for a list of datums available.

## Special 98 - Test Drive Speed & Direction

When you are in the Demonstration Mode (Special 99), you can use SPECIAL 98 to start simulated "cruising"; change the simulated direction, or you can halt the simulated speed and direction. Press SPECIAL 98, then press ENTER. The Pilot GPS will show:

**SPEED = 0**  
**dir = 1234**

If you do not wish to have simulated speed and direction, press 0. If you do wish to have simulated speed, then you must give the Pilot GPS a direction; press 1 for North, 2 for East, 3 for South or 4 for West. If you select a direction, the simulated speed will be 6 knots. Simulated speed is always 6 knots, or it is 0.

# Start Up Locations (U.S.)

Use the following table to find the location nearest you. Enter these numbers exactly as they appear. These numbers are not to be used for navigation, but only as start-up data for the Pilot GPS.

	LAI	LQN	GRI
<b>ALABAMA</b>			
Bayou La Batre	30 20.00	088 15.00	7980
Gulf Shores	30 15.00	087 40.00	7980
Mobile	30 40.00	088 00.00	7980
<b>ALASKA</b>			
Anchorage	61 10.00	149 50.00	7960
Juneau	58 25.00	134 30.00	7960
Ketchikan	55 20.00	131 35.00	7960
<b>ARIZONA</b>			
Page	36 57.00	111 27.00	9610
Roosevelt Res.	33 45.00	111 00.00	9610
Yuma	32 40.00	114 40.00	9610
<b>CALIFORNIA</b>			
Big Sur	36 10.00	121 45.00	9940
Bodega Bay	38 20.00	123 00.00	9940
Crescent City	41 45.00	124 10.00	9940
Eureka	40 50.00	124 10.00	9940
Fort Bragg	39 30.00	123 50.00	9940
Grover City	35 05.00	120 35.00	9940
Half Moon Bay	37 30.00	122 25.00	9940
Imperial Beach	32 40.00	117 10.00	9940
Long Beach	33 45.00	118 15.00	9940
Monterey	36 35.00	121 50.00	9940
Monro Bay	35 20.00	120 50.00	9940
Newport Beach	33 40.00	118 00.00	9940
Oceanside	33 15.00	117 25.00	9940
Point Arena	38 50.00	123 40.00	9940
P. Conception	34 25.00	120 25.00	9940
Port Hueneume	34 10.00	119 10.00	9940
Redondo Beach	33 50.00	118 20.00	9940
Rockport	39 45.00	123 45.00	9940
San Diego	32 45.00	117 15.00	9940
San Francisco	37 50.00	122 25.00	9940
San Simeon	35 35.00	121 10.00	9940
Santa Barbara	34 25.00	119 40.00	9940
Santa Cruz	36 55.00	122 00.00	9940
Santa Monica	34 00.00	118 25.00	9940
Ventura	34 15.00	119 20.00	9940

	LAI	LQN	GRI
<b>CONNECTICUT</b>			
Bridgeport	41 10.00	073 10.00	9960
New Haven	41 15.00	072 55.00	9960
New London	41 20.00	072 05.00	9960
Stamford	41 05.00	073 30.00	9960
<b>DELAWARE</b>			
Delaware Bay	39 00.00	075 20.00	9960
Rehoboth Beach	38 40.00	075 10.00	9960
<b>FLORIDA</b>			
Apalachicola	29 45.00	085 00.00	7980
Boca Raton	26 20.00	080 00.00	7980
Bradenton	27 30.00	082 35.00	7980
Cape Coral	26 35.00	082 00.00	7980
Cedar Key	29 10.00	083 00.00	7980
Clearwater	28 00.00	082 50.00	7980
Cocoa Beach	28 20.00	080 35.00	7980
Crystal River	28 55.00	082 40.00	7980
Daytona Beach	29 15.00	081 00.00	7980
Destin	30 25.00	086 30.00	7980
Fort Lauderdale	26 10.00	080 10.00	7980
Fort Pierce	27 30.00	080 20.00	7980
Hollywood	26 00.00	080 10.00	7980
Jacksonville B.	30 15.00	081 20.00	7980
Jensen Beach	27 15.00	080 10.00	7980
Key Biscayne	25 40.00	080 10.00	7980
Key Largo	25 10.00	080 25.00	7980
Key West	25 30.00	081 50.00	7980
Marathon	24 40.00	081 10.00	7980
Marco	25 55.00	081 45.00	7980
Melbourne	28 05.00	080 30.00	7980
Miami	25 45.00	080 10.00	7980
Naples	26 10.00	081 50.00	7980
New Smyrna B	29 00.00	080 55.00	7980
Panama City	30 10.00	085 40.00	7980
Pensacola	30 25.00	087 15.00	7980
Pompano Beach	26 15.00	080 05.00	7980
Port Ritzhey	28 20.00	082 45.00	7980
Port St. Joe	29 50.00	085 20.00	7980
Punta Gorda	26 55.00	082 00.00	7980
Sarasota	27 20.00	082 30.00	7980
St. Augustine B.	29 50.00	081 10.00	7980
St. Petersburg	27 45.00	082 40.00	7980
Tampa	27 55.00	082 30.00	7980
Tarpon Springs	28 10.00	082 50.00	7980
Titusville	28 40.00	080 40.00	7980
Venice	27 05.00	082 30.00	7980
Vero Beach	27 40.00	080 20.00	7980
West Palm Beach	26 50.00	080 00.00	7980

LAI LON GRI

MASSACHUSETTS

Boston 42 20.00 071 00.00 9960  
 Eastham 41 50.00 070 00.00 9960  
 Falmouth 41 30.00 070 35.00 9960  
 Gloucester 42 35.00 070 40.00 9960  
 Lynn 42 30.00 070 55.00 9960  
 New Bedford 41 40.00 070 55.00 9960  
 Newburyport 42 45.00 070 50.00 9960  
 Plymouth 42 00.00 070 40.00 9960  
 Pocasset 41 40.00 070 40.00 9960  
 Provincetown 42 05.00 070 10.00 9960  
 Quincy 42 15.00 071 00.00 9960  
 Sagamore 41 45.00 070 30.00 9960  
 Salem 42 30.00 070 55.00 9960  
 S. Yarmouth 41 40.00 070 10.00 9960

MICHIGAN

Alpena 45 00.00 083 30.00 8970  
 Bay City 43 40.00 083 55.00 8970  
 Benton Harbor 42 05.00 086 35.00 8970  
 Cheboygan 45 40.00 084 30.00 8970  
 Copper Harbor 47 30.00 087 55.00 8970  
 Detroit 42 20.00 083 00.00 9960  
 Escanaba 45 40.00 087 05.00 8970  
 Gould City 46 10.00 085 45.00 8970  
 Grand Marais 46 40.00 086 00.00 8970  
 Hessel 46 00.00 084 25.00 8970  
 Holland 42 50.00 086 15.00 8970  
 Houghton 47 05.00 088 30.00 8970  
 Ludington 43 55.00 086 30.00 8970  
 Manistee 44 15.00 086 20.00 8970  
 Manistique 45 55.00 086 15.00 8970  
 Marquette 46 35.00 087 20.00 8970  
 Menominee 45 10.00 087 35.00 8970  
 Monroe 41 50.00 083 15.00 8970  
 Munising 46 25.00 086 35.00 8970  
 Muskegon 43 10.00 086 25.00 8970  
 Northport 45 05.00 085 40.00 8970  
 Onkama 44 25.00 086 20.00 8970  
 Ontonagon 46 50.00 089 20.00 8970  
 Petoskey 45 20.00 085 00.00 8970  
 Port Austin 44 00.00 083 00.00 8970  
 Port Hope 44 00.00 082 50.00 9960  
 Port Huron 43 00.00 082 30.00 8970  
 South Haven 42 25.00 086 20.00 8970  
 St. Ignace 45 50.00 084 45.00 8970  
 Tawas City 44 20.00 083 25.00 8970  
 Whitefish Point 46 45.00 085 00.00 8970

MINNESOTA

Duluth 46 45.00 092 00.00 8970  
 Grand Marais 47 50.00 090 20.00 8970  
 Grand Polage 48 00.00 089 40.00 8970  
 Silver Bay 47 15.00 091 15.00 8970  
 Two Harbors 47 00.00 091 40.00 8970

LAI LON GRI

GEORGIA

Burnswick 31 10.00 081 25.00 7980  
 Savannah 32 00.00 081 10.00 7980

HAWAII

Honolulu 21 20.00 157 50.00 4990  
 Kailua-Kona 19 50.00 155 60.00 4990  
 Lahaina 20 50.00 156 40.00 4990

IDAHO

Coeur d'Alene 47 32.00 116 39.00 8290  
 Idaho Falls 43 30.00 112 01.00 9940  
 Sandpoint 48 17.00 116 34.00 8290

ILLINOIS

Chicago 41 50.00 087 35.00 8970  
 Evanston 42 00.00 087 45.00 8970  
 Waukegan 42 20.00 087 50.00 8970

INDIANA

Gary 41 30.00 087 15.00 8970

LOUISIANA

Abbeville 29 55.00 092 05.00 7980  
 Cameron 29 45.00 093 20.00 7980  
 Houma 29 30.00 090 40.00 7980  
 Lake Charles 30 10.00 093 10.00 7980  
 Morgan City 29 35.00 091 10.00 7980  
 New Iberia 30 00.00 091 50.00 7980  
 New Orleans 30 00.00 090 00.00 7980  
 Slidell 30 10.00 089 45.00 7980

MAINE

Bar Harbor 44 20.00 068 15.00 9960  
 Belfast 44 25.00 069 00.00 9960  
 Brunswick 44 00.00 070 00.00 9960  
 Milbridge 44 30.00 067 50.00 9960  
 Perry 45 00.00 067 00.00 9960  
 Rockland 44 00.00 069 00.00 9960  
 Portland 43 40.00 070 20.00 9960

MARYLAND

Annapolis 39 00.00 076 30.00 9960  
 Cambridge 38 35.00 076 05.00 9960  
 Crisfield 38 00.00 075 50.00 9960  
 Lexington Park 38 15.00 076 25.00 9960  
 Ocean City 38 20.00 075 05.00 9960

	LAI	LON	GRI	LAI	LON	GRI
<b>MISSISSIPPI</b>						
Bay St. Louis	30 20.00	089 20.00	7980			
Boxi	30 25.00	088 55.00	7980			
Guilford	30 20.00	089 05.00	7980			
Pascagoula	30 20.00	088 35.00	7980			
<b>MONTANA</b>						
Fort Peck	47 58.00	106 30.00	8290			
Polson	47 40.00	114 10.00	8290			
Yellowstone Lake	44 27.00	110 03.00	9610			
<b>NEBRASKA</b>						
Ogallala	41 08.00	101 44.00	8970			
Omaha	41 18.00	095 57.00	8970			
<b>NEW HAMPSHIRE</b>						
Portsmouth	43 00.00	070 45.00	9960			
<b>NEW JERSEY</b>						
Asbury Park	40 15.00	074 00.00	9960			
Atlantic City	39 20.00	074 25.00	9960			
Cape May	38 55.00	074 55.00	9960			
Delaware Bay	39 15.00	075 15.00	9960			
Perth Amboy	40 30.00	074 15.00	9960			
Point Pleasant	40 05.00	074 00.00	9960			
Sandy Hook	40 30.00	074 00.00	9960			
Stone Harbor	39 00.00	074 45.00	9960			
<b>NEW MEXICO</b>						
Elephant Butte	33 25.00	107 10.00	9610			
Fort Sumner	34 30.00	104 17.00	9610			
<b>NEW YORK</b>						
Bayshore	40 45.00	073 15.00	9960			
Buffalo	42 50.00	078 55.00	9960			
Dunkirk	42 30.00	079 20.00	9960			
Greenport	41 05.00	072 20.00	9960			
Kings Point	40 50.00	073 45.00	9960			
Lakeside Beach	43 20.00	078 15.00	9960			
Long Beach	40 35.00	073 35.00	9960			
Mastic	40 50.00	072 50.00	9960			
Montauk	41 00.00	072 00.00	9960			
New Rochelle	40 55.00	073 45.00	9960			
Northport	40 55.00	073 21.00	9960			
Oswego	43 25.00	076 30.00	9960			
Riverhead	40 55.00	072 40.00	9960			
Rochester	43 15.00	077 35.00	9960			
Roosevelt Beach	43 20.00	078 50.00	9960			
Sag Harbor	41 00.00	072 15.00	9960			
South Hampton	40 50.00	072 20.00	9960			
Stony Brook	41 00.00	073 10.00	9960			
Watertown	44 00.00	076 00.00	9960			
<b>NORTH CAROLINA</b>						
Elizabeth City	36 20.00	076 10.00	9960			
Englehard	35 30.00	076 00.00	9960			
Hatteras	35 15.00	075 45.00	9960			
Hobacken	35 15.00	076 30.00	9960			
Kitty Hawk	36 05.00	075 45.00	9960			
Morehead City	34 45.00	076 40.00	9960			
New Bern	35 10.00	077 00.00	9960			
Washington	35 30.00	077 00.00	9960			
Wilmington	34 15.00	078 00.00	9960			
<b>NORTH DAKOTA</b>						
Bismark	46 48.00	100 46.00	8290			
Grand Forks	47 55.00	097 05.00	8290			
Lake Sakakawea	47 49.00	101 58.00	8290			
<b>OHIO</b>						
Ashtabula	41 55.00	080 50.00	9960			
Cleveland	41 30.00	081 45.00	9960			
Sandusky	41 25.00	082 40.00	9960			
Toledo	41 40.00	083 30.00	9960			
<b>OREGON</b>						
Astoria	46 10.00	123 50.00	9940			
Brookings	42 05.00	124 25.00	9940			
Cooos Bay	43 20.00	124 20.00	9940			
Florence	44 00.00	124 05.00	9940			
Gold Beach	42 25.00	124 20.00	9940			
Lincoln City	44 55.00	124 00.00	9940			
Newport	44 40.00	124 00.00	9940			
Port Orford	42 45.00	124 30.00	9940			
Portland	45 35.00	122 40.00	9940			
Reedsport	43 40.00	124 10.00	9940			
Seaside	46 00.00	124 00.00	9940			
Tillamook	45 30.00	123 55.00	9940			
<b>PENNSYLVANIA</b>						
Erie	42 10.00	080 05.00	9960			
<b>RHODE ISLAND</b>						
Namagansett	41 25.00	071 25.00	9960			
Newport	41 30.00	071 20.00	9960			
Warwick	41 40.00	071 20.00	9960			
<b>SOUTH CAROLINA</b>						
Charleston	32 50.00	080 00.00	7980			
Georgetown	33 20.00	079 20.00	7980			
Hilton Head Is.	32 10.00	080 45.00	7980			
Myrtle Beach	33 40.00	079 00.00	7980			
<b>SOUTH DAKOTA</b>						
Pierre	44 22.00	100 20.00	8290			
Sioux Falls	43 33.00	096 43.00	8970			

# Start Up Locations (International)

TEXAS	LAI	LON	GRI
Avansas Pass	27 50.00	097 10.00	7980
Baytown	29 40.00	095 00.00	7980
Beaumont	30 00.00	094 10.00	7980
Corpus Christi	27 45.00	097 20.00	7980
Freeport	28 55.00	095 10.00	7980
Galveston	29 20.00	094 40.00	7980
Port Arthur	29 55.00	094 00.00	7980
Port Isabel	26 00.00	097 15.00	7980
Port Lavaca	28 35.00	096 30.00	7980
Port Mansfield	26 30.00	097 20.00	7980
UTAH			
Provo	40 15.00	111 40.00	9610
Salt Lake City	40 45.00	111 52.00	9610
VIRGINIA			
Burgess	37 50.00	076 15.00	9960
Cape Charles	37 15.00	076 00.00	9960
Hampton	37 00.00	076 15.00	9960
Virginia Beach	36 50.00	076 00.00	9960
WASHINGTON			
Anacortes	48 30.00	122 35.00	5990
Bellingham	48 45.00	122 30.00	5990
Cape Flattery	48 20.00	124 40.00	5990
Everett	48 00.00	122 10.00	5990
Ilwaco	46 15.00	124 00.00	9940
La Push	47 50.00	124 35.00	5990
Neah Bay			
Oak Harbor	48 15.00	122 35.00	5990
Port Angeles	48 05.00	123 35.00	5990
Port Townsend	48 05.00	122 45.00	5990
Queets	47 30.00	124 20.00	5990
Seattle	47 35.00	122 25.00	5990
South Bend	46 40.00	123 55.00	9940
Tacoma	47 15.00	122 35.00	5990
Westport	46 50.00	124 05.00	9940
WISCONSIN			
Ashland	46 40.00	090 50.00	8970
Green Bay	44 35.00	087 55.00	8970
Kenosha	42 35.00	087 50.00	8970
Manitowoc	44 05.00	087 40.00	8970
Marinette	45 05.00	087 35.00	8970
Milwaukee	43 00.00	087 55.00	8970
Port Wing	46 50.00	091 30.00	8970
Red Cliff	46 50.00	090 45.00	8970
Sheboygan	43 45.00	087 45.00	8970
Sister Bay	45 15.00	087 10.00	8970
Sturgeon Bay	44 50.00	087 20.00	8970
Superior	46 45.00	092 00.00	8970
WYOMING			
Pathfinder Res.	42 22.00	107 10.00	9610
Shoshone Lake	44 17.00	110 50.00	9610

Acapulco	16 49.00 N	099 57.00 W	Manila	14 37.00 N
Ajman	25 15.00 N	054 30.00 E	Marseille	120 46.00 E
Ankara	40 04.00 N	032 46.00 E	Marquesas Is.	43 18.00 N
Athens	38 00.00 N	023 38.00 E	Montreal	005 25.00 E
Azores	37 47.00 N	025 41.00 W	Nantes	08 50.00 S
Bangkok	13 50.00 N	100 29.00 E	Noumea	141 00.00 W
Barcelona	41 25.00 N	002 08.00 E	Oslo	45 36.00 W
Belize City	17 31.00 N	088 10.00 W	Panama	073 38.00 W
Buenos Aires	34 20.00 S	058 30.00 W	Perth	47 13.00 N
Cabo San Lucas	22 45.00 N	109 45.00 W	Quebec	001 37.00 W
Cairo	30 11.00 N	031 01.00 E	Reykjavik	22 18.00 S
Cape Town	33 48.00 S	018 28.00 E	Riga	166 48.00 E
Caracas	10 30.00 N	066 58.00 W	Reme	59 46.00 N
Copenhagen	55 43.00 N	012 27.00 E	San Juan	010 33.00 E
Cyprus	35 00.00 N	031 00.00 E	Schwechat	08 35.00 N
Fiji Is.	18 40.00 S	175 00.00 E	Seoul	081 08.00 W
Guatemala	14 37.00 N	090 32.00 W	Shanghai	31 50.00 S
Guayaquil	02 16.00 S	079 53.00 W	Singapore	116 10.00 E
Hamburg	53 34.00 N	010 02.00 E	Sri Lanka	46 49.00 N
Helsinki	60 10.00 N	024 53.00 E	Stockholm	071 13.00 W
Hong Kong	22 21.00 N	114 07.00 E	Sydney	64 10.00 N
Hrvatska	45 24.00 N	015 18.00 E	Tahiti	021 54.00 N
Kuwait	29 00.00 N	048 45.00 E	Tokyo	56 55.00 N
Lisbon	38 42.00 N	009 05.00 W	Tonga Is.	024 05.00 E
London	51 29.00 N	000 09.00 E	Toronto	42 06.00 N
Malta	35 52.00 N	013 30.00 E	Vancouver	18 30.00 W
				175 20.00 W
				43 40.00 N
				079 23.00 W
				49 16.00 N
				123 06.00 W

# Troubleshooting

## NO TURN ON MESSAGE

If the **Pilot GPS** just beeps after turning it On, make sure it is properly installed and that your DC voltage supply is 10 to 16 Volts. If it simply will not turn On (not even a beep), first check the in-line fuse on the power cable (DO NOT replace with larger than 2 Amp). If it still will not turn On, have a marine electronic technician check the installation.

## CONTINUOUS SEARCH MESSAGES

If the **Pilot GPS** continues to display "0 SATS" for an extended time, the receiver may not be in contact with the antenna. Inspect the cable connections at the antenna module and at the back of the **Pilot GPS** display unit to ensure they are clean, dry and there are no bent pins. Also check the cable to ensure it has not been cut or crushed.

If the **Pilot GPS** is not consistent in locking on to the minimal three satellites necessary to provide a position, make sure there are no obstructions to the antenna's view of the sky.

## NOT CURRENT MESSAGES

Please note that there can be brief periods of time when the **Pilot GPS** could have the minimal three satellites in view, but the orientation of the satellites in the sky is such that an accurate fix cannot be provided. If you get a "not Current" message for a brief time, there need not be cause for concern.

If the **Pilot GPS** continues to have a problem staying locked on to satellites, try turning it off, then on again. Re-initialize the receiver by doing Special 01. If this does not correct the problem, contact your nearest authorized Service Center, or call **Interphase Customer Service** for assistance.

## LATITUDE/LONGITUDE

The convention for expressing Latitude and Longitude coordinates in marine electronics (and the **Pilot GPS**), is in degrees, minutes and hundredths of a minute, as opposed to degrees, minutes and seconds used on most charts. This is done because of the greater accuracy possible with modern, electronic navigation devices. To convert seconds to hundredths, multiply by 1.67; to convert hundredths to seconds, multiply by 0.6.

## SPEED & DISTANCE

The **Pilot GPS** displays speed in knots (nautical miles per hour). Distance is displayed in nautical miles. A nautical mile is equal to 6072 feet, as compared to a U.S., or statute, mile which is equal to 5280 feet. To convert statute miles to nautical miles, multiply by 1.15; to convert nautical miles to statute miles, divide by 1.15.

Seven segment display alphabet:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z  
 a b c d e f g h i j k l m n o p q r s t u v w x y z  
 0 1 2 3 4 5 6 7 8 9

# Specifications

## Main Features:

- Multi-channel sequential receiver
- Latitude/Longitude, TD conversion
- Time of day and date (24 hour clock)
- 100 Waypoint memory
- 10 Routes (reversible), 16 waypoints each
- Waypoint Arrival and Anchor alarms
- Differential ready, RTCM SC104 protocol

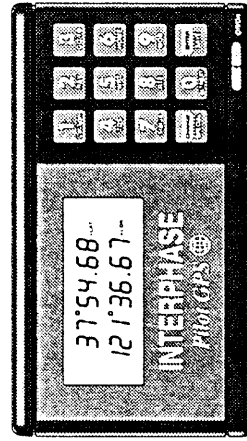
## Physical Characteristics:

- Unit dimensions: 7"W x 4"H x 2.5"D
- Unit weight: 1.2 lbs.
- Antenna dimensions: 3.05" diameter, 3.10" H
- Antenna weight: 4.3 oz.
- Antenna cable: RG-59, 75 Ohm, F-type connectors, 30' L, 13.4 oz.

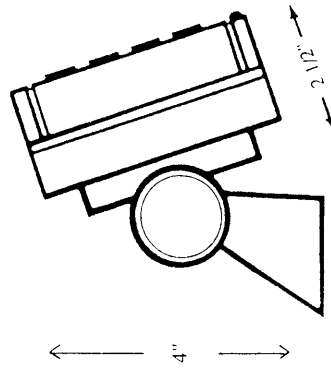
## Performance Specifications

- L1 frequency, C/A Code (SPS), multiple-channel sequencing receiver, tracks 8 satellites
- Update rate: 1 second capability
- Accuracy (Position): 25 meters without SA
- DGPS Accuracy (Position): 2 to 5 meters
- Velocity: 0.1 m/sec
- Acceleration: 2 g

- Power: 12 VDC nominal (10-16 VDC), < 0.5 amps
- Operating temperature range: Unit 0 to 60°C (32 to 140° F), Antenna -40 to 85°C (-40 to 185°F)



7"



4"

## Parts List

- 12 VDC Power Cord
- Mounting Bracket
- In Dash Bracket (option)
- Knobs
- Antenna
- Antenna Cable (30')
- Operation Manual

## Part Number

- 04-0001-008
- 17-0028-017
- 17-0052-014
- 10-0008-017
- 36-0006-026
- 04-0012-026
- 25-0024-026

